

PATENT ABSTRACTS OF JAPAN

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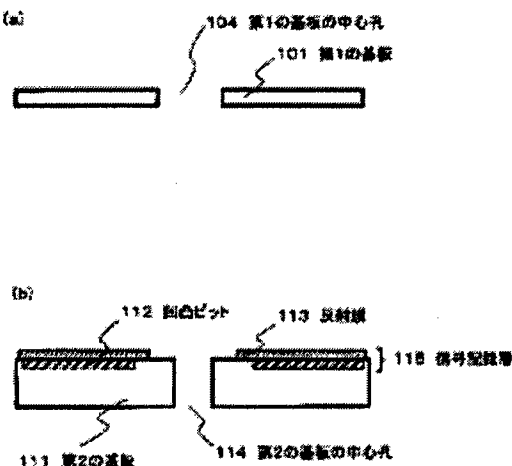
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(54) MANUFACTURE OF OPTICAL DISK AND OPTICAL DISK

(57)Abstract:

PROBLEM TO BE SOLVED: To solve the problem that the tilt of an optical disk is hardly controlled at least when the thicknesses of two substrates to be adhered are different and, besides, methods for producing the two substrates are different in the optical disk where a reproduction side substrate is thin.

SOLUTION: The first substrate is annealed before adhering the first and second substrate 101 and 111. Moreover, it is favorable that the second substrate and the disk after adhesion are also annealed.



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CLAIMS

[Claim(s)]

[Claim 1]A manufacturing method of an optical disc annealing in an optical disc which pastes the 1st substrate and 2nd substrate together before said 1st substrate is thinner than said 2nd substrate and said 1st substrate pastes together to said 2nd substrate.

[Claim 2]A manufacturing method of the optical disc according to claim 1, wherein thickness of said 1st substrate is 0.3 mm or less.

[Claim 3]A manufacturing method of the optical disc according to claim 2, wherein thickness of said 1st substrate is abbreviated 0.1mm.

[Claim 4]A manufacturing method of the optical disc according to any one of claims 1 to 3, wherein processes of said 1st substrate and said 2nd substrate differ.

[Claim 5]A manufacturing method of the optical disc according to claim 1 or 4 in which said 1st substrate is characterized by being produced from a sheet formed by casting method.

[Claim 6]A manufacturing method of the optical disc according to claim 1 or 4, wherein said 2nd substrate is produced by injection molding.

[Claim 7]A manufacturing method of the optical disc according to claim 1 or 4, wherein materials of said 1st substrate and said 2nd substrate differ.

[Claim 8]A manufacturing method of the optical disc according to claim 1 characterized by annealing before pasting said 2nd substrate together to said 1st substrate.

[Claim 9]A manufacturing method of the optical disc according to claim 1 pasting said 1st substrate and said 2nd substrate together by radiation-curing nature resin.

[Claim 10]A manufacturing method of the optical disc according to claim 1 characterized by annealing after pasting said 1st substrate and said 2nd substrate together.

[Claim 11]A manufacturing method of the optical disc according to claim 1, wherein said annealing is performed 5 minutes or more under environment of 60 temperature or more.

[Claim 12]A manufacturing method of the optical disc according to claim 11, wherein said

annealing is performed under environment of 100 temperature abbreviation for abbreviated 1 hour.

[Claim 13]An optical disc produced with the manufacturing method according to any one of claims 1 to 12.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]Especially this invention relates to the manufacturing method of the optical disc which made thin the near substrate with which a laser beam enters about the manufacturing method of an optical disc.

[0002]

[Description of the Prior Art]In recent years, in the field of Information Storage Division, research on various light information records is advanced. Densification is possible for this light information record, and record and reproduction can be performed by non-contact, and application for a use broad as a method which can realize it cheaply is being realized. There is an optical disc as a medium of this light information record. This optical disc can be divided roughly into an only for [playback] type, the added type of a postscript, and an erasable type. As a disk called the laser disc (LD) which recorded the disk called the compact disc (CD) which recorded music information, and picture information, an only for [playback] type, As a document file, a still picture file, etc., further, an erasable type is commercialized as a data file for personal computers, etc., and the added type of a postscript has spread through the world widely. These optical discs provide an information layer in 1.2-mm-thick transparent resin boards, provide an information layer in both the structure which protected it with overcoat, or both [one side or] 1.2-mm, and have the structure which pasted these two sheets together. [0003]In order to record animations, such as not only a sound but a movie, as information, the digital versatile disc (DVD) which is a more nearly mass optical disc is developed and commercialized, and is already spreading. For realization of a high density optical disk like DVD, the method of using an object lens with a big numerical aperture (NA) short was taken in the laser wavelength. However, short wavelength formation and high NA-ization make small the acceptable value of the degree of angle of inclination of the disk to the injection direction of

a laser beam (tilt). It is effective to make substrate thickness thin, for enlarging the acceptable value of a tilt, for example, in DVD, a laser wavelength is 650 nm, NA is 0.60, and substrate thickness is 0.6 mm. Since a mechanical strength is weak and a 0.6-mm-thick resin substrate produces a tilt in its simple substance, DVD has structure which carried out the Information Storage Division side inside, and pasted two substrates together.

[0004]Using lamination structure, to the Information Storage Division side of one sheet between two substrates to paste together Gold, The reflecting layer which becomes the Information Storage Division side of one more sheet from conventional aluminum etc. about the reflecting layer of the translucency of silicon etc., Membranes are formed, respectively, it pastes together so that these Information Storage Division sides may become inside, and one side reproduction two-layer DVD which reproduces both Information Storage Division sides from the substrate side which provided the reflecting layer of translucency is also commercialized. Although it is the still more nearly same two-layer composition, the rewritable DVD in which the Information Storage Division side provided not a metallic reflective layer but the rewritable thin film recording layer is also proposed.

[0005]In recent years, the request to a storage memory with the capacity which can record high-definition television broadcasting for 2 hours is strong with the spread of high-definition television broadcasts (high-definition television broadcasting). As a method of raising the storage density of an optical disc to 20 to 25 GB corresponding to it, the method of enlarging NA of an object lens of using blue-purple color laser is examined. It is proposed that it makes still thinner thickness of the record side / reproduction side board, and sets wavelength of about 0.85 and laser to about 400 nm for NA since the one where the thickness of the record side / reproduction side board is thinner can enlarge the acceptable value of a tilt as described above.

[0006]

[Problem(s) to be Solved by the Invention]However, even if the record side / playback side board becomes thin, in order to maintain the compatibility of disk thickness with CD or DVD, it is preferred that the thickness of an optical disc is 1.2 mm. It becomes the structure where the thickness of two substrates to paste together changes with these. When the record side / reproduction side board is set to 0.3 mm or less, it becomes difficult to form a substrate by injection molding. Therefore, when another substrate is formed by injection molding as usual, the processes of two substrates to paste together differ, respectively. Therefore, a difference is mainly born to the direction or strength of remaining stress generated inside a substrate according to these two points at the time of each substrate formation, and control of the circumferential domestic disturbance moving amount of the radial tilting of a disk and also control of the radial tilting variation in accelerated test order are difficult.

[0007]Then, an object of this invention is to provide the manufacturing method of the optical

disc corresponding to slimming down of the substrate.

[0008]

[Means for Solving the Problem] In order to solve an aforementioned problem, it anneals, before a manufacturing method of this invention has the 1st substrate thinner than the 2nd substrate in an optical disc which pastes the 1st substrate and 2nd substrate together and the 1st substrate pastes together to the 2nd substrate. By a manufacturing method of an optical disc of above-mentioned this invention, control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order are easy. Annealing here is heat treatment which removes or eases remaining stress in material and which is performed for accumulating, and it says carrying out fixed time neglect into a certain temperature atmosphere.

[0009] It is preferred that thickness of the 1st substrate is 0.3 mm or less in the above-mentioned manufacturing method. By this, even if it enlarges short wavelength formation or NA for record / playback laser to about 400 nm about 0.9 for densification of an optical disc, a tilt margin equivalent to DVD can be obtained.

[0010] It is preferred that thickness of the 1st substrate is abbreviated 0.1mm in the above-mentioned manufacturing method. By this, a tilt margin equivalent to DVD can be obtained to short wavelength formation of record / playback laser, and a raise in NA, and further densification of an optical disc becomes possible.

[0011] When processes of the 1st substrate and the 2nd substrate differ, the above-mentioned manufacturing method is more effective to control of a circumferential domestic disturbance moving amount of radial tilting, and also control of radial tilting variation in accelerated test order.

[0012] It is preferred that the 1st substrate is produced in the above-mentioned manufacturing method from a sheet formed by casting method. It becomes easy to make into abbreviated homogeneity thickness of the 1st substrate that is the record side / reproduction side board by this.

[0013] It is preferred that the 2nd substrate is produced by injection molding in the above-mentioned manufacturing method. By using the same technique as conventional CD and DVD, it is producible with the same equipment.

[0014] It is preferred that materials of the 1st substrate and the 2nd substrate differ in the above-mentioned manufacturing method. Control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order become easy by changing material in consideration of a coefficient of thermal expansion or a rate of swelling, according to a ratio of thickness of the 1st substrate and the 2nd substrate, so that it may balance. As the 2nd substrate, rigidity is high and it is also effective to use what has few bent volume.

[0015]Annealing is preferred before pasting the 2nd substrate together to the 1st substrate in the above-mentioned manufacturing method. By this, control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order become still easier.

[0016]It is preferred to paste the 1st substrate and 2nd substrate together by radiation-curing nature resin in the above-mentioned manufacturing method. By this, it is producible by the same technique as the conventional DVD.

[0017]Annealing is preferred after pasting the 1st substrate and 2nd substrate together in the above-mentioned manufacturing method. By this, control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order become still easier.

[0018]It is preferred to perform annealing 5 minutes or more under environment of 60 temperature or more in the above-mentioned manufacturing method. By this, annealing becomes effective.

[0019]It is preferred to be carried out under environment where annealing is 100 temperature abbreviation for abbreviated 1 hour. By this, annealing becomes the most effective.

[0020]With an optical disc produced with the above-mentioned manufacturing method, it becomes stable record or renewable and densification is realized.

[0021]

[Embodiment of the Invention](Embodiment 1) An embodiment of the invention is described hereafter, referring to Drawings. Here, an example is given and explained about the manufacturing method of the optical disc of this invention. (Table 1) And drawing 1 to drawing 5 is an example of the optical disc manufacturing method by this invention.

[0022]

[Table 1]

	アニール処理			ラジアルチルトの 周内変化量	加速試験前後のラ ジアルチルト変化量
	第1の基板	第2の基板	貼り合わせ後		
A	なし	なし	なし	0.40	0.50
B	あり	なし	なし	0.25	0.22
C	なし	前後	なし	0.28	0.40
D	あり	前	なし	0.23	0.21
E	あり	後	なし	0.22	0.20
F	あり	前後	なし	0.21	0.19
G	あり	前後	あり	0.20	0.15

[0023]The effect acquired by this invention was shown in (Table 1). The accelerated test was an examination which investigates the durability of the disk under the environment of heat and high humidity, the optical disc was put into the environment of the temperature of 70 **, and 50% of humidity for 96 hours, and the alpha angle estimated the radial tilting 24 hours after an accelerated test here. An alpha angle is an angle at which the incident light and catoptric light

at the time of entering into the point of measurement make the laser beam which clamps an optical disc and intersects perpendicularly with a clamp surface.

[0024]The amount of domestic-disturbance[circumferential]-izing is a difference of the maximum of the measured value of a certain radius round, and the minimum, and the variation in accelerated test order is a difference of the average value of the measured value of a certain radius round in accelerated test order. Here, radial tilting measurement was performed all over the optical disc, and the maximum was evaluated.

[0025]It means that "it is" performs annealing treatment for "it is nothing" of the annealing treatment column of (Table 1) not carrying out annealing treatment. It means, respectively that "order" performs annealing treatment for the "rest" performing annealing treatment for a "front" performing annealing treatment before signal recording layer formation after signal recording layer formation before signal recording layer formation and to the back.

[0026]The 1st substrate 101 of drawing 1 (a) is a with 90 micrometers in thickness, 119.5 mm in diameter, and a diameter of a feed hole of 20 mm polycarbonate board. Acrylic resin or norbornene system resin may be sufficient as this 1st substrate. The 1st substrate 101 pierced and formed the sheet made by casting method. It is dramatically difficult for thickness to produce a substrate of 0.3 mm or less by injection molding. It is possible to produce even a thickness of 0.3 mm or less to abbreviated homogeneity by casting method to it.

[0027]The 2nd substrate 111 of drawing 1 (b) is a with 1.1 mm in thickness, 120 mm in diameter, and a diameter of a feed hole of 15 mm polycarbonate board, and equips one principal surface with the uneven pit 112. Acrylic resin, polyolefin system resin, etc. may be sufficient as this 2nd substrate, and materials other than resin may be sufficient as it. Since the 2nd substrate is not the record side / reproduction side board, it may be opaque. The 2nd substrate was formed by injection molding. The abbreviated 100-nm weld slag of the reflection film 113 which uses aluminum as the main ingredients was carried out to the uneven pit, and the signal recording layer 115 was formed. Metal other than aluminum, for example, Ag, Si, etc. may be sufficient as a reflection film. Here, although the case where the number of signal recording layers is one is shown in the 2nd substrate, there may be two or more signal recording layers.

[0028]Annealing treatment of the 1st substrate 101 was carried out at 100 ** for 1 hour. The remaining stress produced the process until it forms the 1st substrate by this can be eased. The situation of annealing treatment was shown in drawing 2. Since the 1st substrate 101 turns into the record side / reproduction side board, it is preferred that it becomes dirty in the principal surface, or there is no crack. It is preferred that the holding method which can ease remaining stress more is used. Here, it carried out by the method as shown in drawing 2 (a) and (b). The support which cannot touch the field which record of the 1st substrate and regenerated light penetrate is preferred. In drawing 2 (a), by the bearing bar 121, the inner

circumference portion was fixed and it held vertically. In drawing 2 (b), it held horizontally with the buck 123. By A of (Table 1), and comparison of the B column, it turns out that the tilt of a disk improves substantially by this. Annealing treatment of the sheet produced with casting method is carried out, it may pierce after that, and the 1st substrate may be formed.

[0029]From comparison of A and C of (Table 1), the same annealing treatment also as the 2nd substrate 111 may be performed. Under the present circumstances, it is preferred to anneal, after forming a signal recording layer so that D and E of (Table 1) may show. It turns out that it is preferred to anneal from D, E, and F of (Table 1) before and after forming a signal recording layer. By carrying out annealing treatment of the 2nd substrate, the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order are controlled more.

[0030]A reflection film is formed and stress occurs in the 2nd substrate by forming a signal recording layer. Therefore, the effect of control of the direction which performed annealing treatment after the signal recording layer formation forward of the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order is large. By easing the remaining stress which exists in the 2nd substrate before signal recording layer formation by annealing, in addition easing the stress by signal recording layer formation after signal recording layer formation, The effect of control of the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order becomes still larger.

[0031]The 1st substrate 101 and 2nd substrate 111 were pasted together by the radiation-curing nature resin 202 after annealing treatment. Here, like drawing 3 (a), apply the radiation-curing nature resin 202 to an approximate circle ring type on the 1st substrate 101, and like drawing 3 (b), From the upper part, pile up the 2nd substrate 111 so that it may become an approximately concentric circle, and like drawing 4 (a) after that, The 1st substrate and 2nd substrate unified via the radiation-curing nature resin 202 were rotated, the radiation-curing nature resin 202 was extended, and it was made abbreviated homogeneity, and like drawing 4 (b), it irradiated with radiation and radiation-curing nature resin was hardened.

[0032]Radiation-curing nature resin is resin hardened with radiation here, and radiation is the mind containing all the electromagnetic waves and particle waves. Specifically, radiation-curing nature resin includes the ultraviolet curing resin hardened by UV irradiation, the resin hardened by electron beam irradiation, etc. Radiation-curing nature resin may be applied to the 2nd substrate, and the 1st substrate may be piled up from the upper part.

[0033]Lamination of the 1st substrate and the 2nd substrate may be performed in a vacuum. In this case, while pasting together, the spin coat of the radiation-curing nature resin is carried out like drawing 5 (a) to the field which both substrates paste together, it lays in a vacuum like drawing 5 (b) after that on top of it, and radiation-curing nature resin is hardened by radiation

irradiation to it. It becomes unnecessary to care about mixing of air bubbles by performing lamination in a vacuum.

[0034]After pasting the 1st substrate and 2nd substrate together, still more nearly same annealing treatment may be performed. It is possible to control more the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order so that the G column of (Table 1) may show.

[0035]In order to raise the intensity of the 1st substrate that is the record side / reproduction side board, it is also possible to give a hard court to the 1st substrate. A hard court here gets damaged and is for prevention or antisticking of dirt. At this time, before a hard court pastes together to the 2nd substrate, it may be performed, and after pasting together, it may be performed. Although control of a tilt may become difficulty more by a hard court, the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order are controlled by performing annealing after a hard court.

[0036]Here, although the case where the processes of the 1st substrate and the 2nd substrate differed was explained, even when the process of the 1st substrate and the 2nd substrate is the same, the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order are controlled by annealing the 1st substrate.

[0037]Although this embodiment explained the only for [what is called playback] type which recorded the information signal as a concavo-convex pit as a signal recording layer, and provided the reflecting layer, it cannot be overemphasized that it may be the recordable type which consists of a thin film layer in which signal record reproduction is possible after disk completion.

[0038]Thus, according to the manufacturing method of this embodiment, the record side / playback side board becomes thin, and it becomes easy control of the circumferential domestic disturbance moving amount of radial tilting and for the radial tilting variation in accelerated test order to control further also in the optical disc that the thickness of two substrates differs from a process.

[0039]As mentioned above, although the example was given and explained about the embodiment of the invention, this invention is not limited to this embodiment, but can be applied to other embodiments based on the technical idea of this invention.

[0040](Embodiment 2) An embodiment of the invention is described hereafter, referring to Drawings. Here, an example is given and explained about the manufacturing method of the optical disc of this invention. Explanation may be omitted about the portion which overlaps with Embodiment 1. (Table 2) And drawing 6 is an example of the optical disc manufacturing method by this invention. The effect acquired by this invention was shown in (Table 2). An accelerated test here, and measurement and evaluation of a tilt are the same as that of Embodiment 1.

[0041]

[Table 2]

	アニール処理			ラジアルチルトの 周内変化量	加速試験前後のラ ジアルチルト変化量
	第1の基板	第2の基板	貼り合わせ後		
A	なし	なし	なし	0.50	0.60
B	前	なし	なし	0.35	0.37
C	後	なし	なし	0.30	0.32
D	前後	なし	なし	0.27	0.27
E	前後	前後	なし	0.23	0.26
F	前後	前後	あり	0.21	0.25

[0042]The 1st substrate 601 of drawing 6 (a) is a with 80 micrometers in thickness, 119.5 mm in diameter, and a diameter of a feed hole of 20 mm acrylic resin substrate. Polycarbonate or norbornene system resin may be sufficient as this 1st substrate. The 1st substrate has the signal recording layer 602 in which record reproduction is possible in one principal surface. The 1st substrate was pierced and produced from the sheet produced with casting method, and formed the signal recording layer 602 after that.

[0043]The 2nd substrate 611 of drawing 6 (b) is a with 1.1 mm in thickness, 120 mm in diameter, and a diameter of a feed hole of 15 mm polycarbonate board, and equips one principal surface with the signal recording layer 612 in which record reproduction is possible. Acrylic resin, polyolefin system resin, etc. may be sufficient as this 2nd substrate, and materials other than resin may be sufficient as it. Since the 2nd substrate is not the record side / reproduction side board, it may be opaque. The 2nd substrate was produced by injection molding and formed the signal recording layer 612 after that.

[0044]Annealing treatment of the 1st substrate 601 was carried out at 100 ** for 1 hour. About the method of annealing treatment, it is the same as that of Embodiment 1. It is preferred to anneal from comparison of A of (Table 2), B, and C, after forming a signal recording layer in this case. It is preferred to anneal from comparison of B, C, and D, before and after forming a signal recording layer.

[0045]The same annealing treatment also as the 2nd substrate 611 may be performed like Embodiment 1. Here, annealing treatment was performed before and after signal recording layer formation. After annealing treatment, each signal recording layer was made to counter and the 1st substrate 601 and 2nd substrate 611 were pasted together by the radiation-curing nature resin 702. The lamination method is the same as that of Embodiment 1.

[0046]After pasting the 1st substrate and 2nd substrate together, still more nearly same annealing treatment may be performed. It is possible to control more the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order so that the F column of (Table 2) may show.

[0047]Although this embodiment explained the case where the signal recording layer which consists of a thin film layer in which signal record reproduction is possible was provided, it

cannot be overemphasized that it may be the only for [reproduction] type which was described by Embodiment 1.

[0048]Here, the case where the materials of the 1st substrate and the 2nd substrate differed was explained. Like Embodiment 1, although the material of the 1st substrate and the 2nd substrate may be the same, it becomes possible by choosing material in consideration of water absorption, a coefficient of thermal expansion, etc. to heighten the annealing effect of the 1st substrate more.

[0049]A hard coat which was stated to the 1st substrate that is the record reproduction side board by Embodiment 1 may be performed. It is preferred to perform annealing treatment after a hard coat also in this case.

[0050]Thus, according to the manufacturing method of this embodiment, the record side / playback side board becomes thin, and it becomes easy control of the circumferential domestic disturbance moving amount of radial tilting and for the radial tilting variation in accelerated test order to control further also in the optical disc that the thickness of two substrates differs from a process.

[0051](Embodiment 3) Here, annealing described by Embodiment 1 and Embodiment 2 is explained. Although annealing treatment of 1 hour was performed under the environment of 100 temperature in Embodiment 1 and Embodiment 2, The size of the effect over control of the circumferential domestic disturbance moving amount of the radial tilting of an optical disc and the radial tilting variation in accelerated test order changes with conditions of the temperature and time at the time of performing annealing.

[0052]The size of the effect by the temperature and time of annealing treatment is shown in drawing 7. The holding method of the 1st substrate 101 and 601 at the time of annealing was performed by the method described by Embodiment 1 and Embodiment 2. The difference in an effect arising from these two holding methods was not accepted. The effect as opposed to [in time] control of the circumferential domestic disturbance moving amount of the radial tilting of an optical disc and the radial tilting variation in accelerated test order at less than 5 minutes was not accepted to any temperature. Even if only anything similarly spent many hours, as for the effect, temperature was not accepted at less than 60 degrees. It is 60 temperature or more and by performing time for 5 minutes or more, and annealing, an effect becomes large more because an effect begins to show up, and make temperature into 80 degrees or more and it carries out time in 30 minutes or more. The effect became large most by performing temperature of 100 degrees or more, and annealing of 1 hours or more. However, annealing in a high temperature which changes the 1st substrate is not preferred. In consideration of the size of an indispensable effect, and the relation of time, it is necessary to perform annealing.

[0053]As mentioned above, as for this invention, although the example was given and explained about the embodiment of the invention, it is obvious that it is not limited to this

embodiment but card shaped recording media, such as a rectangle and polygonal shape, and a disc-like recording medium can be applied to other embodiments based on the technical idea of this inventions, such as what carried out the modification cut.

[0054]

[Effect of the Invention]As mentioned above, according to this invention, in the optical disc which pastes two substrates together, even when the record side / playback side board becomes thin and the thickness of two substrates differs from a process, the optical disc of a good tilt can be produced. Stable record or playback, and densification are realized by this optical disc.

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TECHNICAL FIELD

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PRIOR ART

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between two substrates to paste together Gold, The reflecting layer which becomes the Information Storage Division side of one more sheet from conventional aluminum etc. about the reflecting layer of the translucency of silicon etc., Membranes are formed, respectively, it pastes together so that these Information Storage Division sides may become inside, and one side reproduction two-layer DVD which reproduces both Information Storage Division sides from the substrate side which provided the reflecting layer of translucency is also commercialized. Although it is the still more nearly same two-layer composition, the rewritable DVD in which the Information Storage Division side provided not a metallic reflective layer but the rewritable thin film recording layer is also proposed.

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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, even if the record side / playback side board becomes thin, in order to maintain the compatibility of disk thickness with CD or DVD, it is preferred that the thickness of an optical disc is 1.2 mm. It becomes the structure where the thickness of two substrates to paste together changes with these. When the record side / reproduction side board is set to 0.3 mm or less, it becomes difficult to form a substrate by injection molding. Therefore, when another substrate is formed by injection molding as usual, the processes of two substrates to paste together differ, respectively. Therefore, a difference is mainly born to the direction or strength of remaining stress generated inside a substrate according to these two points at the time of each substrate formation, and control of the circumferential domestic disturbance moving amount of the radial tilting of a disk and also control of the radial tilting variation in accelerated test order are difficult.

[0007]Then, an object of this invention is to provide the manufacturing method of the optical disc corresponding to slimming down of the substrate.

[Translation done.]

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MEANS

[Means for Solving the Problem]In order to solve an aforementioned problem, it anneals, before a manufacturing method of this invention has the 1st substrate thinner than the 2nd substrate in an optical disc which pastes the 1st substrate and 2nd substrate together and the 1st substrate pastes together to the 2nd substrate. By a manufacturing method of an optical disc of above-mentioned this invention, control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order are easy. Annealing here is heat treatment which removes or eases remaining stress in material and which is performed for accumulating, and it says carrying out fixed time neglect into a certain temperature atmosphere.

[0009]It is preferred that thickness of the 1st substrate is 0.3 mm or less in the above-mentioned manufacturing method. By this, even if it enlarges short wavelength formation or NA for record / playback laser to about 400 nm about 0.9 for densification of an optical disc, a tilt margin equivalent to DVD can be obtained.

[0010]It is preferred that thickness of the 1st substrate is abbreviated 0.1mm in the above-mentioned manufacturing method. By this, a tilt margin equivalent to DVD can be obtained to short wavelength formation of record / playback laser, and a raise in NA, and further densification of an optical disc becomes possible.

[0011]When processes of the 1st substrate and the 2nd substrate differ, the above-mentioned manufacturing method is more effective to control of a circumferential domestic disturbance moving amount of radial tilting, and also control of radial tilting variation in accelerated test order.

[0012]It is preferred that the 1st substrate is produced in the above-mentioned manufacturing method from a sheet formed by casting method. It becomes easy to make into abbreviated homogeneity thickness of the 1st substrate that is the record side / reproduction side board by this.

[0013]It is preferred that the 2nd substrate is produced by injection molding in the above-mentioned manufacturing method. By using the same technique as conventional CD and DVD, it is producible with the same equipment.

[0014]It is preferred that materials of the 1st substrate and the 2nd substrate differ in the above-mentioned manufacturing method. Control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order become easy by changing material in consideration of a coefficient of thermal expansion or a rate of swelling, according to a ratio of thickness of the 1st substrate and the 2nd substrate, so that it may balance. As the 2nd substrate, rigidity is high and it is also effective to use what has few bent volume.

[0015]Annealing is preferred before pasting the 2nd substrate together to the 1st substrate in the above-mentioned manufacturing method. By this, control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order become still easier.

[0016]It is preferred to paste the 1st substrate and 2nd substrate together by radiation-curing nature resin in the above-mentioned manufacturing method. By this, it is producible by the same technique as the conventional DVD.

[0017]Annealing is preferred after pasting the 1st substrate and 2nd substrate together in the above-mentioned manufacturing method. By this, control of a circumferential domestic disturbance moving amount of radial tilting and also control of radial tilting variation in accelerated test order become still easier.

[0018]It is preferred to perform annealing 5 minutes or more under environment of 60 temperature or more in the above-mentioned manufacturing method. By this, annealing becomes effective.

[0019]It is preferred to be carried out under environment where annealing is 100 temperature abbreviation for abbreviated 1 hour. By this, annealing becomes the most effective.

[0020]With an optical disc produced with the above-mentioned manufacturing method, it becomes stable record or renewable and densification is realized.

[0021]

[Embodiment of the Invention](Embodiment 1) An embodiment of the invention is described hereafter, referring to Drawings. Here, an example is given and explained about the manufacturing method of the optical disc of this invention. (Table 1) And drawing 1 to drawing 5 is an example of the optical disc manufacturing method by this invention.

[0022]

[Table 1]

	アニール処理			ラジアルチルトの 周内変化量	加速試験前後のラ ジアルチルト変化量
	第1の基板	第2の基板	貼り合わせ後		
A	なし	なし	なし	0.40	0.50
B	あり	なし	なし	0.25	0.22
C	なし	前後	なし	0.28	0.40
D	あり	前	なし	0.23	0.21
E	あり	後	なし	0.22	0.20
F	あり	前後	なし	0.21	0.19
G	あり	前後	あり	0.20	0.15

[0023]The effect acquired by this invention was shown in (Table 1). The accelerated test was an examination which investigates the durability of the disk under the environment of heat and high humidity, the optical disc was put into the environment of the temperature of 70 **, and 50% of humidity for 96 hours, and the alpha angle estimated the radial tilting 24 hours after an accelerated test here. An alpha angle is an angle at which the incident light and catoptric light at the time of entering into the point of measurement make the laser beam which clamps an optical disc and intersects perpendicularly with a clamp surface.

[0024]The amount of domestic-disturbance[circumferential]-izing is a difference of the maximum of the measured value of a certain radius round, and the minimum, and the variation in accelerated test order is a difference of the average value of the measured value of a certain radius round in accelerated test order. Here, radial tilting measurement was performed all over the optical disc, and the maximum was evaluated.

[0025]It means that "it is" performs annealing treatment for "it is nothing" of the annealing treatment column of (Table 1) not carrying out annealing treatment. It means, respectively that "order" performs annealing treatment for the "rest" performing annealing treatment for a "front" performing annealing treatment before signal recording layer formation after signal recording layer formation before signal recording layer formation and to the back.

[0026]The 1st substrate 101 of drawing 1 (a) is a with 90 micrometers in thickness, 119.5 mm in diameter, and a diameter of a feed hole of 20 mm polycarbonate board. Acrylic resin or norbornene system resin may be sufficient as this 1st substrate. The 1st substrate 101 pierced and formed the sheet made by casting method. It is dramatically difficult for thickness to produce a substrate of 0.3 mm or less by injection molding. It is possible to produce even a thickness of 0.3 mm or less to abbreviated homogeneity by casting method to it.

[0027]The 2nd substrate 111 of drawing 1 (b) is a with 1.1 mm in thickness, 120 mm in diameter, and a diameter of a feed hole of 15 mm polycarbonate board, and equips one principal surface with the uneven pit 112. Acrylic resin, polyolefin system resin, etc. may be sufficient as this 2nd substrate, and materials other than resin may be sufficient as it. Since the 2nd substrate is not the record side / reproduction side board, it may be opaque. The 2nd substrate was formed by injection molding. The abbreviated 100-nm weld slag of the reflection film 113 which uses aluminum as the main ingredients was carried out to the uneven pit, and

the signal recording layer 115 was formed. Metal other than aluminum, for example, Ag, Si, etc. may be sufficient as a reflection film. Here, although the case where the number of signal recording layers is one is shown in the 2nd substrate, there may be two or more signal recording layers.

[0028]Annealing treatment of the 1st substrate 101 was carried out at 100 °C for 1 hour. The remaining stress produced the process until it forms the 1st substrate by this can be eased. The situation of annealing treatment was shown in drawing 2. Since the 1st substrate 101 turns into the record side / reproduction side board, it is preferred that it becomes dirty in the principal surface, or there is no crack. It is preferred that the holding method which can ease remaining stress more is used. Here, it carried out by the method as shown in drawing 2 (a) and (b). The support which cannot touch the field which record of the 1st substrate and regenerated light penetrate is preferred. In drawing 2 (a), by the bearing bar 121, the inner circumference portion was fixed and it held vertically. In drawing 2 (b), it held horizontally with the buck 123. By A of (Table 1), and comparison of the B column, it turns out that the tilt of a disk improves substantially by this. Annealing treatment of the sheet produced with casting method is carried out, it may pierce after that, and the 1st substrate may be formed.

[0029]From comparison of A and C of (Table 1), the same annealing treatment also as the 2nd substrate 111 may be performed. Under the present circumstances, it is preferred to anneal, after forming a signal recording layer so that D and E of (Table 1) may show. It turns out that it is preferred to anneal from D, E, and F of (Table 1) before and after forming a signal recording layer. By carrying out annealing treatment of the 2nd substrate, the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order are controlled more.

[0030]A reflection film is formed and stress occurs in the 2nd substrate by forming a signal recording layer. Therefore, the effect of control of the direction which performed annealing treatment after the signal recording layer formation forward of the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order is large. By easing the remaining stress which exists in the 2nd substrate before signal recording layer formation by annealing, in addition easing the stress by signal recording layer formation after signal recording layer formation, The effect of control of the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order becomes still larger.

[0031]The 1st substrate 101 and 2nd substrate 111 were pasted together by the radiation-curing nature resin 202 after annealing treatment. Here, like drawing 3 (a), apply the radiation-curing nature resin 202 to an approximate circle ring type on the 1st substrate 101, and like drawing 3 (b), From the upper part, pile up the 2nd substrate 111 so that it may become an approximately concentric circle, and like drawing 4 (a) after that, The 1st substrate and 2nd

substrate unified via the radiation-curing nature resin 202 were rotated, the radiation-curing nature resin 202 was extended, and it was made abbreviated homogeneity, and like drawing 4 (b), it irradiated with radiation and radiation-curing nature resin was hardened.

[0032]Radiation-curing nature resin is resin hardened with radiation here, and radiation is the mind containing all the electromagnetic waves and particle waves. Specifically, radiation-curing nature resin includes the ultraviolet curing resin hardened by UV irradiation, the resin hardened by electron beam irradiation, etc. Radiation-curing nature resin may be applied to the 2nd substrate, and the 1st substrate may be piled up from the upper part.

[0033]Lamination of the 1st substrate and the 2nd substrate may be performed in a vacuum. In this case, while pasting together, the spin coat of the radiation-curing nature resin is carried out like drawing 5 (a) to the field which both substrates paste together, it lays in a vacuum like drawing 5 (b) after that on top of it, and radiation-curing nature resin is hardened by radiation irradiation to it. It becomes unnecessary to care about mixing of air bubbles by performing lamination in a vacuum.

[0034]After pasting the 1st substrate and 2nd substrate together, still more nearly same annealing treatment may be performed. It is possible to control more the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order so that the G column of (Table 1) may show.

[0035]In order to raise the intensity of the 1st substrate that is the record side / reproduction side board, it is also possible to give a hard court to the 1st substrate. A hard court here gets damaged and is for prevention or antisticking of dirt. At this time, before a hard court pastes together to the 2nd substrate, it may be performed, and after pasting together, it may be performed. Although control of a tilt may become difficulty more by a hard court, the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order are controlled by performing annealing after a hard court.

[0036]Here, although the case where the processes of the 1st substrate and the 2nd substrate differed was explained, even when the process of the 1st substrate and the 2nd substrate is the same, the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order are controlled by annealing the 1st substrate.

[0037]Although this embodiment explained the only for [what is called playback] type which recorded the information signal as a concavo-convex pit as a signal recording layer, and provided the reflecting layer, it cannot be overemphasized that it may be the recordable type which consists of a thin film layer in which signal record reproduction is possible after disk completion.

[0038]Thus, according to the manufacturing method of this embodiment, the record side / playback side board becomes thin, and it becomes easy control of the circumferential domestic disturbance moving amount of radial tilting and for the radial tilting variation in accelerated test

order to control further also in the optical disc that the thickness of two substrates differs from a process.

[0039]As mentioned above, although the example was given and explained about the embodiment of the invention, this invention is not limited to this embodiment, but can be applied to other embodiments based on the technical idea of this invention.

[0040](Embodiment 2) An embodiment of the invention is described hereafter, referring to Drawings. Here, an example is given and explained about the manufacturing method of the optical disc of this invention. Explanation may be omitted about the portion which overlaps with Embodiment 1. (Table 2) And drawing 6 is an example of the optical disc manufacturing method by this invention. The effect acquired by this invention was shown in (Table 2). An accelerated test here, and measurement and evaluation of a tilt are the same as that of Embodiment 1.

[0041]

[Table 2]

	アニール処理			ラジアルチルトの 周内変化量	加速試験前後のラ ジアルチルト変化量
	第1の基板	第2の基板	貼り合わせ後		
A	なし	なし	なし	0.50	0.60
B	前	なし	なし	0.35	0.37
C	後	なし	なし	0.30	0.32
D	前後	なし	なし	0.27	0.27
E	前後	前後	なし	0.23	0.26
F	前後	前後	あり	0.21	0.25

[0042]The 1st substrate 601 of drawing 6 (a) is a with 80 micrometers in thickness, 119.5 mm in diameter, and a diameter of a feed hole of 20 mm acrylic resin substrate. Polycarbonate or norbornene system resin may be sufficient as this 1st substrate. The 1st substrate has the signal recording layer 602 in which record reproduction is possible in one principal surface. The 1st substrate was pierced and produced from the sheet produced with casting method, and formed the signal recording layer 602 after that.

[0043]The 2nd substrate 611 of drawing 6 (b) is a with 1.1 mm in thickness, 120 mm in diameter, and a diameter of a feed hole of 15 mm polycarbonate board, and equips one principal surface with the signal recording layer 612 in which record reproduction is possible. Acrylic resin, polyolefin system resin, etc. may be sufficient as this 2nd substrate, and materials other than resin may be sufficient as it. Since the 2nd substrate is not the record side / reproduction side board, it may be opaque. The 2nd substrate was produced by injection molding and formed the signal recording layer 612 after that.

[0044]Annealing treatment of the 1st substrate 601 was carried out at 100 ** for 1 hour. About the method of annealing treatment, it is the same as that of Embodiment 1. It is preferred to anneal from comparison of A of (Table 2), B, and C, after forming a signal recording layer in this case. It is preferred to anneal from comparison of B, C, and D, before and after forming a

signal recording layer.

[0045]The same annealing treatment also as the 2nd substrate 611 may be performed like Embodiment 1. Here, annealing treatment was performed before and after signal recording layer formation. After annealing treatment, each signal recording layer was made to counter and the 1st substrate 601 and 2nd substrate 611 were pasted together by the radiation-curing nature resin 702. The lamination method is the same as that of Embodiment 1.

[0046]After pasting the 1st substrate and 2nd substrate together, still more nearly same annealing treatment may be performed. It is possible to control more the circumferential domestic disturbance moving amount of radial tilting and the radial tilting variation in accelerated test order so that the F column of (Table 2) may show.

[0047]Although this embodiment explained the case where the signal recording layer which consists of a thin film layer in which signal record reproduction is possible was provided, it cannot be overemphasized that it may be the only for [reproduction] type which was described by Embodiment 1.

[0048]Here, the case where the materials of the 1st substrate and the 2nd substrate differed was explained. Like Embodiment 1, although the material of the 1st substrate and the 2nd substrate may be the same, it becomes possible by choosing material in consideration of water absorption, a coefficient of thermal expansion, etc. to heighten the annealing effect of the 1st substrate more.

[0049]A hard court which was stated to the 1st substrate that is the record reproduction side board by Embodiment 1 may be performed. It is preferred to perform annealing treatment after a hard court also in this case.

[0050]Thus, according to the manufacturing method of this embodiment, the record side / playback side board becomes thin, and it becomes easy control of the circumferential domestic disturbance moving amount of radial tilting and for the radial tilting variation in accelerated test order to control further also in the optical disc that the thickness of two substrates differs from a process.

[0051](Embodiment 3) Here, annealing described by Embodiment 1 and Embodiment 2 is explained. Although annealing treatment of 1 hour was performed under the environment of 100 temperature in Embodiment 1 and Embodiment 2, The size of the effect over control of the circumferential domestic disturbance moving amount of the radial tilting of an optical disc and the radial tilting variation in accelerated test order changes with conditions of the temperature and time at the time of performing annealing.

[0052]The size of the effect by the temperature and time of annealing treatment is shown in drawing 7. The holding method of the 1st substrate 101 and 601 at the time of annealing was performed by the method described by Embodiment 1 and Embodiment 2. The difference in an effect arising from these two holding methods was not accepted. The effect as opposed to [in

time] control of the circumferential domestic disturbance moving amount of the radial tilting of an optical disc and the radial tilting variation in accelerated test order at less than 5 minutes was not accepted to any temperature. Even if only anything similarly spent many hours, as for the effect, temperature was not accepted at less than 60 degrees. It is 60 temperature or more and by performing time for 5 minutes or more, and annealing, an effect becomes large more because an effect begins to show up, and make temperature into 80 degrees or more and it carries out time in 30 minutes or more. The effect became large most by performing temperature of 100 degrees or more, and annealing of 1 hours or more. However, annealing in a high temperature which changes the 1st substrate is not preferred. In consideration of the size of an indispensable effect, and the relation of time, it is necessary to perform annealing. [0053]As mentioned above, as for this invention, although the example was given and explained about the embodiment of the invention, it is obvious that it is not limited to this embodiment but card shaped recording media, such as a rectangle and polygonal shape, and a disc-like recording medium can be applied to other embodiments based on the technical idea of this inventions, such as what carried out the modification cut.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The figure showing the manufacturing method of the optical disc by this invention

[Drawing 2]The figure showing the manufacturing method of the optical disc by this invention

[Drawing 3]The figure showing the manufacturing method of the optical disc by this invention

[Drawing 4]The figure showing the manufacturing method of the optical disc by this invention

[Drawing 5]The figure showing the manufacturing method of the optical disc by this invention

[Drawing 6]The figure showing other examples about the manufacturing method of the optical disc of this invention

[Drawing 7]The figure showing the effect of the manufacturing method of the optical disc of this invention

[Description of Notations]

101,601 The 1st substrate

104,604 Feed hole of the 1st substrate

111,611 The 2nd substrate

112 Uneven pit

113 Reflection film

114,614 Feed hole of the 2nd substrate

115,602,612 Signal recording layer

121 Bearing bar

122 Annealing furnace

123 Buck

201 Nozzle

202,702 Radiation-curing nature resin

203 Drop

204 Radiation

205 Vacuum chamber

[Translation done.]

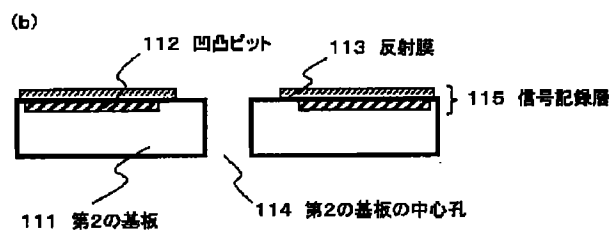
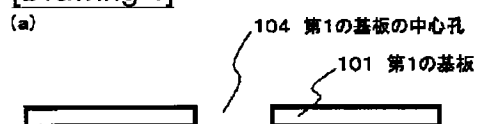
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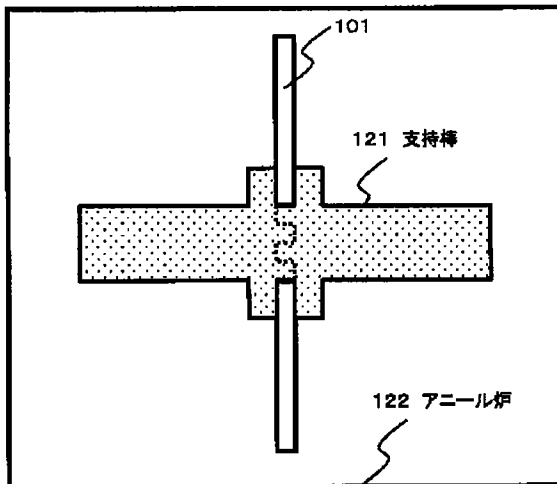
DRAWINGS

[Drawing 1]

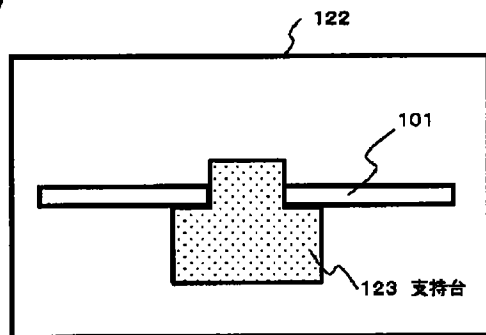


[Drawing 2]

(a)

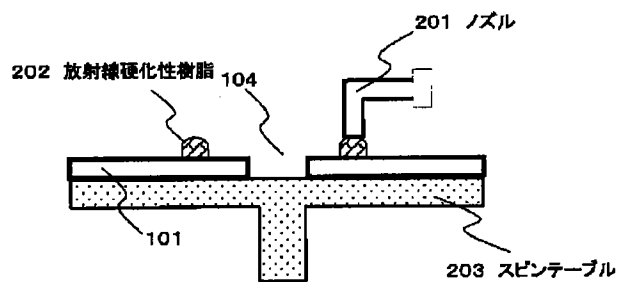


(b)

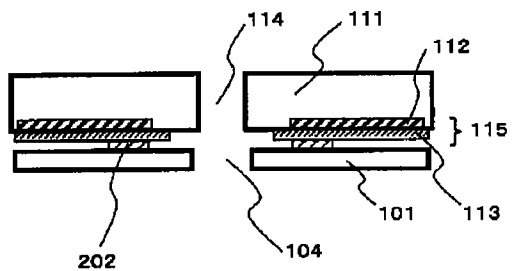


[Drawing 3]

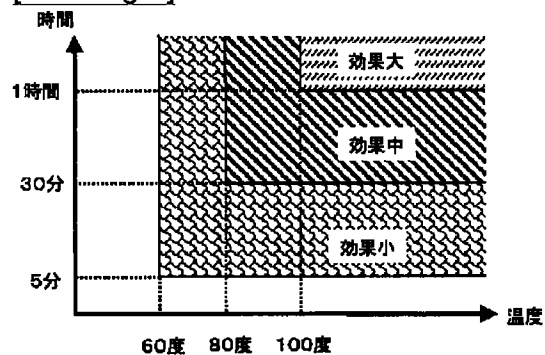
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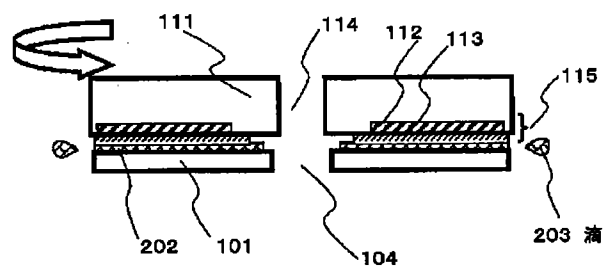


[Drawing 7]

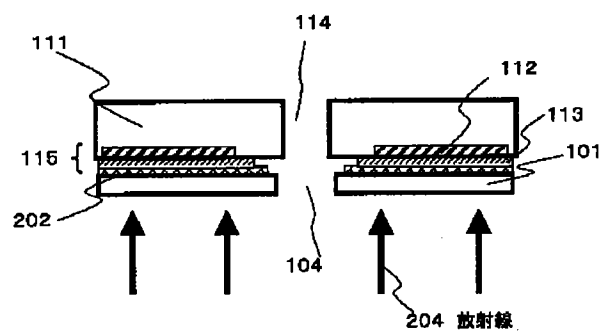


[Drawing 4]

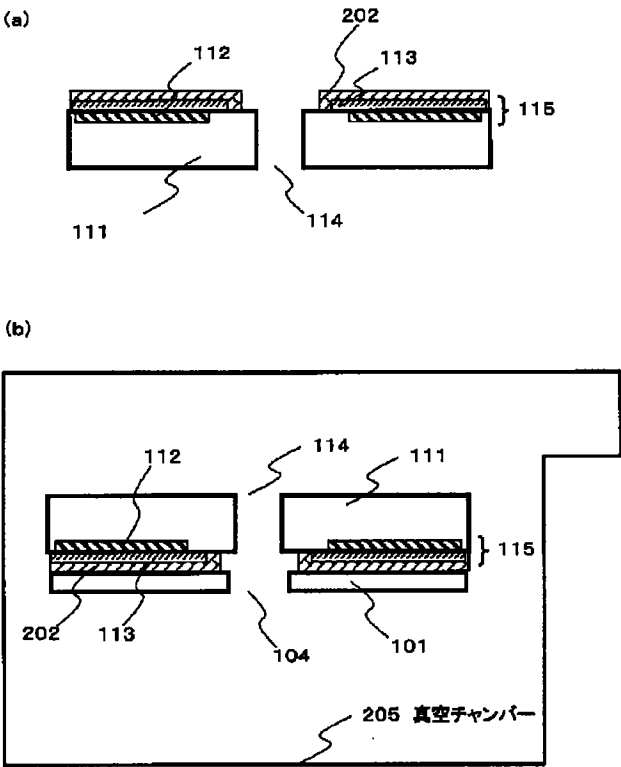
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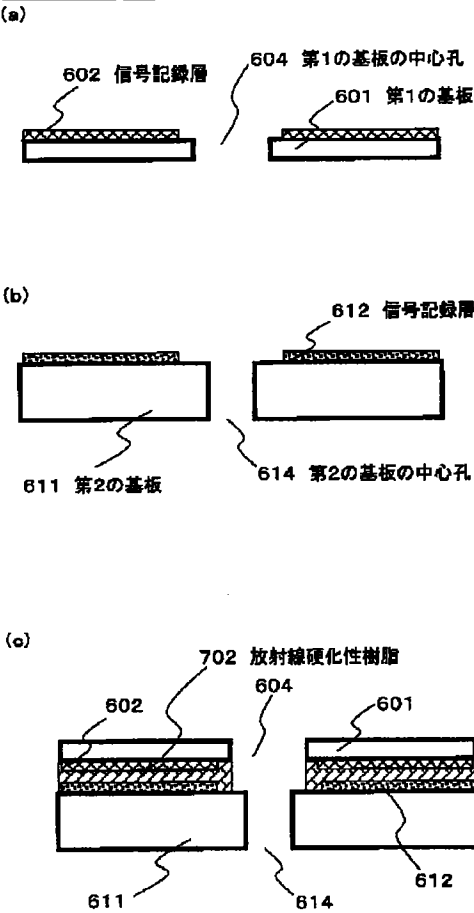
(b)



[Drawing 5]



[Drawing 6]



[Translation done.]